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PUBLIC WORKS

CITY COUNTY STATE

LAYING REINFORCED CONCRETE SEWER PIPE IN A ROCK TRENCH IN NEW YORK CITY

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MAY 14, 1921

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Laying Reinforced Concrete Sewers in Bronx Borough, New York

More than three miles of reinforced concrete sewer pipe up to 66 inches inside diameter cast in yards and laid in trenches in the Borough of Bronx, New York City. Four-foot sections assembled in trench and joints completed at the rate of five minutes each.

The Holland avenue contract for more than one mile of sewer is now being executed by Charles W. McDonald; and the contract for more than a mile of Eden Terrace sewer, and for similar length for the 233d Street sewer, is being executed by the Fenlack Construction Co. The inside diameter of the Holland Avenue sewer varies from 51 inches to 66 inches, while that of the Eden Terrace and 233d Street sewers varies from 24 to 57 inches inside. These contracts are under the supervision of the Department of Sewers, Borough of Bronx, New York City, Col. Austin, engineer in charge. Work is being executed in accordance with the standard specifications of the department for reinforced pipe, the pipe used being manufactured according to their regular standards by the Core Joint Pipe Co., Inc., at two yards established by the company in the vicinity of these respective jobs.

TRENCH EXCAVATION

The trench for the Holland Street sewer is almost wholly in rock excavation, much of it from 20 to 30 feet deep through irregular miscellaneous strata of limestone, shale, micaceous schist and decomposed hard and soft rock, with the strata inclined in every direction, making it difficult to drill and blast. The trench has an average width of about 6 or 7 feet, with very jagged sides because there are no definite planes of cleavage in the rock.

For the Holland Avenue sewer the excavation is made in two lifts or benches, in each of which there are drilled three one-inch vertical holes 1¼ inches diameter at the bottom, that are made with jack hammer machines at the rate of about 22 feet per hour and are charged with 5 or 6 pounds of 60 per cent dynamite cartridges. The holes are placed about 3½ feet back from the front of the bench and the rock is shattered so that little sledging or block drilling is necessary for handling and removing it. An average of two 3-hole shots are fired daily by each of the four 6-men gangs, thus extending the trench about 3½ feet per day, an amount that governs the completion of finished sewer.

The spoil is loaded by hand into one-yard steel tilting buckets, hoisted by a stiff-leg derrick, and dumped alongside, where it remains only a short time, being used in a few days for backfill as fast as the pipe is laid in five or six-section lengths, thus permitting the trench to be backfilled within 40 to 60 feet of the blasting face, according to depth.

PLANT AT HOLLAND AVENUE, BOROUGH OF THE BRONX, NEW YORK, FOR MANUFACTURING, SEASONING AND STORING REINFORCED CONCRETE SEWER PIPE.

PROTECTING BLASTS

The end of the finished sewer is protected by a bulkhead of timber, and the blasts are covered by wire rope mattresses and logs which effectually prevent any damage by flying rocks. The mattresses are made by the contractor at the site at a cost very much less than it would require to purchase them in the market. To make them, short iron stakes are driven about 6 inches apart into the hard, level surface of the ground on the four sides of an 8 x 10-foot rectangle. Around them are wound and tightly stretched ¾-inch wire rope, forming the warp, while a more flexible ⅝-inch rope is wound back and forth transversely, forming the woof of the fabric. The ropes are wound around the stakes by hand, weaving a very close basketwork pattern and making a satisfactory and economical mattress, which will last from two to six months when in constant use. Worn out guy and hoist ropes of no commercial value are used for the mattress, which weighs about two tons and can be made in four days by a single workman.

The drills are operated by compressed air from an Ingersoll-Rand compressor having a capacity of 500 cubic feet of free air per minute, which is installed at the contractor's power plant. The air is maintained at a pressure of about 100 pounds in a receiver of about 200 cubic feet capacity that supplies a Leyner tool dressing machine and four Ingersoll-Rand drills.

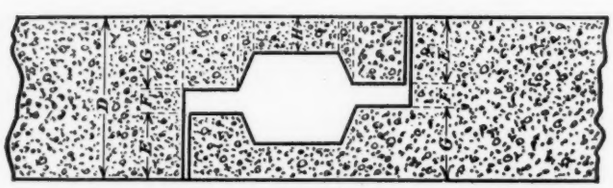
The sections are excavated upgrade and therefore require little pumping except in one or two cases where pulsometers are installed. They require little or no sheeting and bracing except at the crossing under the elevated railroad and adjacent to buried conduits and mains.

MAKING THE PIPES

The pipe used in this work is that known as the "Core Joint" concrete pipe, and is manufactured in yards obtained for the purpose near where they are being laid.

The pipes are cast vertically in sections 4 feet long, made with 1:2:4 concrete with aggregate not exceeding 1 inch in diameter. The thickness varies from 3 to 6½ inches, and the weight from about 600 to 7,000 pounds per section of the sizes used on these jobs. Each section is reinforced by a 4-inch full length cylindrical web of American Steel & Wire Co.'s triangular mesh, concentric with the axis of the pipe and at a minimum distance of 1¼ inches from the inner surface of the pipe. Pipes with a diameter of 48 inches or more have a second similar reinforcement at a minimum distance of 1⅜ inches from the outer surface of the pipe.

The joints are made in the thickness of the regular pipe walls, being flush inside and outside, the exterior of the spigot and the interior of the hub being recessed so as to form, when adjacent sections are assembled together, six-sided annular spaces, which, together with narrow cylindrical spaces separating the ends of the sections, are filled with grout after the pipes have been assembled and aligned. The density of the concrete in the pipes is so great that they have endured a hydrostatic test of 40 pounds per square inch without any sign of percolation or sweating.



CROSS-SECTION OF JOINT OF "CORE JOINT" PIPE SHOWS ANNULAR SPACE TO BE FILLED WITH CEMENT GROUT AFTER PIPES HAVE BEEN LAID

PIPE MANUFACTURE

The pipes for the Eden Terrace and the 233d Street sewers are made in the Boston Road yard conveniently located near the line of the 233d Street sewer. Two-inch planks are laid on the surface of the ground and on them are placed the bottom rings required for the female ends of the pipes, which are cast down. The inside forms are assembled on the rings, after which the reinforcement fabric, cut to required length, is assembled by hand around the inner form, being easily sprung to the required curve and the ends wired together at the overlap, thus forming a cylinder of the exact size of the pipe sections and accurately gauged by the bottom ring which the pipe encloses. When a double reinforcement is required, a second cylinder of triangular mesh fabric is assembled in the same manner, after which the outer form is put in position. As the reinforcing fabric is received in rolls having a width slightly greater than the length of the pipe sections, the reinforcement cylinder is conveniently shortened to the exact length required by making two sharp bends ¾ inch apart, in each of the diagonal wires connecting the upper two circumferential rods of the cylindrical reinforcement, which is thus quickly reduced in length by any required amount less than one inch. This adjustment is very easily effected by a crank handle with slotted bit that engages the light wire and twists it 90 degrees or more with a single motion.

The forms are then filled with concrete, which is thoroughly tamped and rodded with narrow bars inserted adjacent to both outer and inner form shells and between the reinforcement sheets, thus automatically maintaining the latter in accurate concentric positions. Cement mortar is then placed in the top of the form and the top joint rings are pressed down in it and compact it until it overflows and insures that the space is thoroughly filled with mortar enclosing the reinforcement that strengthens the outer edge of the joint.

CONCRETING

The concreting is done by a force of about 6 men and a foreman, who cast 7 pieces of 60-inch pipe in one 8-hour day, or with a force of 10 men and a foreman who can make 13 pieces in one 8-hour day. As the pipe for all these contracts is manufactured for the contractors by the pipe company, the latter has found it convenient to establish a yard at Holland avenue, similar to the one described, and to cast pipes for both jobs by the same force operating at one yard one day and the other yard the next day. This leaves

48 hours for a batch of pipes to set before the men return and strip them, setting up the forms on an extra set of bottom rings and allowing the new pipes to harden for six days more before they are lifted from their bases and moved to position on the storage skids, where they are allowed to harden at least 6 days longer before being laid in the trench. The work is so well planned and carefully executed that practically 100 per cent of the pipes cast have been acceptable to the inspector.

Concrete is mixed in a ½-yard Ransome machine mounted on an elevated platform at one end of the yard that is served by a derrick handling the aggregate and cement, the former being stored on the ground nearby where it is delivered by automobile trucks. The mixer discharges into wheelbarrows which deliver the concrete over a gangway supported by trestles set up as required in the aisle between two rows of forms.

PIPE FORMS

Each yard is equipped with about 25 complete forms and twice as many bottom rings for each size of pipe manufactured there. The inner and outer forms are made of No. 16 gauge sheet steel, each cylinder being made, according to size, in 2 to 4 segments, secured together by joints made with flanges that are almost instantly engaged, tightened, locked and released by a single movement of the knuckle handle. The cast iron joint rings are each made in two or more segments according to diameter and are connected with pins at the ends. They are machine finished to very accurate dimensions and the cylinder forms are thoroughly cleaned by scraping and brushed with oil each time they are used.

PIPE LAYING

From the storage skids in the yards where they are manufactured the pipes are rolled by hand up inclined skids to trucks, on which they are transported alongside the trench as required and delivered to derricks, which lower them to position in the bottom of the trench. If they are too large to be rolled up the inclined skids by hand, they are loaded by the aid of a rolling hitch on the end of a rope operated by a team or an automobile.

In lowering the pipe sections of maximum weights up to 7,000 pounds, they are easily handled by means of special hooks made of forged bars up to 2½ inches square. The hook has two parallel legs far enough apart to clear the walls of the pipe. The long leg, going inside the pipe, is nearly as long as the pipe section, and the short leg is only one half as long, or about 2 feet long, provided with a clevis at the end that is attached to hoisting tackle and automatically spots the latter at the center of gravity of the pipe when the hook is slipped as far as it will go over the end of the pipe.

The pipe can thus be safely handled in a horizontal position without danger of slipping. It is lowered to the bed leveled for it on the bottom of the trench and the spigot end is guided into the bell end of the preceding pipe, and the pipe is carefully aligned. The next section is then laid, and so on, as many as seven sections having been assembled and aligned in 30 minutes. After the pipe has been aligned, a man enters it with a little cement mortar and "muds" the interior joints, about ¼ inch wide, while a similar operation is performed on the exterior of the joints. Holes about 6 inches square are then chiseled in each joint from the exterior at any convenient point, usually at the crown of the pipe, and through the holes is poured 1:1 Portland cement grout of a consistency of cream, that fills the joints completely, after which the pouring hole is plastered up and the joint is finished.

The McDonald contract is being executed with an average force of about 60 men, who under favorable circumstances lay about 50 feet of 66-inch sewer per month. The work on the Fenlack contract is carried on in a similar manner at about the same speed, and by about the same number of men.

PIPE MANUFACTURING PLANT AND YARD, BOSTON ROAD, BOROUGH OF THE BRONX, NEW YORK

Court Powerless to Compel Sewerage

The Supreme Court of Michigan has ruled that no state court can compel a municipality to lay sewers in any particular street or dictate the manner of making any other public improvements. This decision was rendered in connection with an appeal from a mandamus issued by the State Circuit Court last year, on the request of the owner of 322 lots in that district, ordering the city to proceed with the construction of sewers in a certain section of North Detroit. The Supreme Court held that in carrying out public works, municipal authorities are vested with a quasi-judicial discretion and courts have no power to order them to make all alike or to keep all in the same state of repair.

Grading Road With Tractors and Wheel Scrapers

By W. B. Hill, Jr.

Contractor used two outfits of a tractor and two trailers each for hauls exceeding 150 feet. Figures of force employed, dirt moved, etc., and dynamometer test of draw-bar pull.

The Dixon-Henderson road in Webster county, Kentucky, is a Federal Aid project, forming part of the Dixie Bee line running from Chicago to Florida. The section under consideration (Project 39, Sec. C) is about five miles long and winds around the Kentucky hills with few level stretches, and with grades of from 2 to 6 per cent.

The contract calls for moving about 35,000 yards of dirt, putting in some 20 concrete culverts and clearing and grubbing about 2½ acres of ground. Free haul is 500 feet with an overhaul of about 13,000 feet on 5,000 yards. Character of soil is limestone clay, free from rock. The work is being done by Townsend, Mitchell & Carter as contractors.

Work was started in September, 1920, with teams alone. Operations were stopped for the year on December 17. During the last month and a half "caterpillar" tractors and scrapers were used, replacing all except 4 teams. In 1921 work was begun on April 4 with the same equipment—two trains, each consisting of a 5-ton Holt "caterpillar" tractor and two Maney four-wheel scrapers.

The method of operation is to use the tractors on hauls of 150 feet and up, and teams and slip scrapers on all of the shorter hauls. This gives the contractor an equipment so flexible and efficient that he can handle any given condition with maximum economy.

The efficiency of teams is well known on hauls of around 100 feet, on hauls across the road, knocking down short steep banks, filling up deep holes and washouts, etc. But where teams begin to cost real money is on the longer hauls. It is this condition that the tractor-drawn wheel scrapers handle best.

The following are typical examples of the amount of dirt these outfits have moved: Working up and down a 6 per cent grade that was to be cut to 5 per cent, on an overhaul of about 1,300 feet, Mr. Mitchell found that one tractor outfit averaged him about 120 yards a day and the two outfits about 240 yards. On another hill, of 5 per cent grade, he found he was averaging around 200 yards with each outfit on a 600-foot haul per 10-hour day.

Six men are employed as operators; 2 on the tractors and 1 on each of the 4 scrapers. On hauls of around 200 yards, one power outfit loads 180 yards from the fill; second outfit 220 yards from fill. This prevents delays. On longer hauls this is unnecessary. One scraper man is generally used to handle a train of 2 or 3 Maneys, but Mr. Mitchell has found it better economy to use one man on each scraper for the following reasons:

1st—They take better care of scrapers and keep them in better running order.

2d—They take a great interest in their particular scraper.

3d—They like the job because seat is very comfortable and work is not hard.

4th—They can get a bigger load per trip.

5th—They can make a smoother, evener cut.

6th—They are a great help in the morning, speeding up work of greasing tractor and scraper wheels.

7th—They provide an extra man for an emergency.

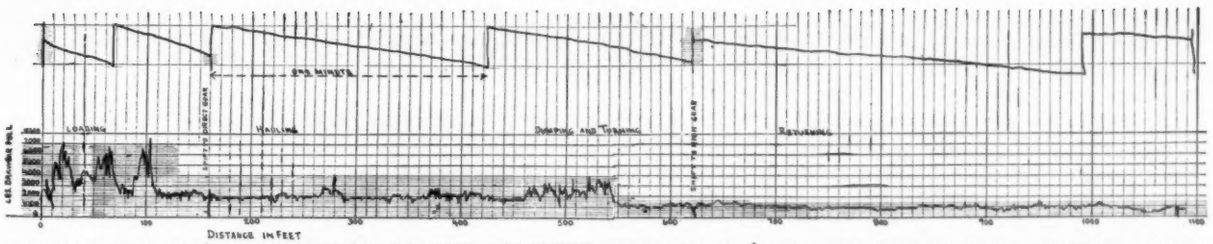
8th—They cost little. With dirt paid at the prevailing rate, and the extra operator getting $3, a few more yards of dirt pays his daily salary.

The road is about 24 feet wide, which gives ample room for passing at any point. The tractors turn the scrapers easily within this radius, and when necessary can turn within 18 or 20 feet. In going over or turning on soft fills, up grade, or through mud, the tractors have ample power to pull the scrapers. In fact, Mr. Mitchell handles all of his tractor operations on direct gear, rarely if ever using low gear of the tractor, which gives approximately twice as much power.

After a rain, operations can be resumed very quickly on account of the track laying construction of the "caterpillars," which gives them a firm footing over soft ground. A thin cut is made to take off the top layer of mud. The sub-soil then encountered is dry, and there are no further difficulties. Plowing is unnecessary except in one or two cases; when making deep cuts of from 7 to 10 feet, it is sometimes necessary to plow through the very hard clay found at this depth.

Before starting work on any particular section, the stakes are taken out and set on one side of the road. Particular attention is paid to getting down to grade on the crown; the sides being later finished with an 8-foot blade grader pulled by one of the tractors.

Mr. Mitchell has found that his four teams are particularly useful in smoothing out the road ahead of his wheel scrapers. For example, on coming to a gully some 30 feet wide with nearly perpendicular banks about 8 feet high that crossed the right-of-way, he worked his teams with slip scrapers all day, filling in the bottom and plowing the banks down somewhat. When he had made roughly a 25 per cent grade out of the banks, he moved his teams up farther ahead



DYNAMOMETER TEST OF MANEY FOUR-WHEEL SCRAPERS, THREE DRAWN BY 5-TON CATERPILLAR TRACTOR. MADE IN MEDIUM DAMP CLAY SOIL AT PEORIA, ILL., FEBRUARY 19, 1921, BY A. R. SQUYER, RESEARCH ENGINEER.

and put his tractors and scrapers to work on the fill. As the two outfits dump four full yards on every trip, the remainder of the fill was made in a short time. Such obstacles as trees, hedges, stumps and heavy roots are either dragged out by the tractors or chopped out by hand.

The contractor is doing his own concrete work and is using a small one-bag mixer for this, a foreman and five laborers being employed in this work.

EQUIPMENT AND PERSONNEL

The total equipment employed on this job is as follows:

Two 5-ton "caterpillar" tractors, 4 Maney four-wheel scrapers, 4 No. 2 slip scrapers, 1 plow, 1 blade grader (8 ft.), 1 Dodge touring car, 1 International truck, 1 concrete mixer (1 bag), 75 feet of chain and small tools.

The personnel is: 1 contractor, 2 tractor operators, 4 scraper operators, 4 mule team drivers (hired with teams), 1 dump man, 1 roustabout, 1 man for clearing right-of-way, 1 loader (for teams), 1 truck driver, 1 concrete mixer foreman, and 5 laborers on mixer.

Below is given a table of capacities showing amount of dirt the 5-ton "caterpillar" has moved daily, hauling 2 and 3 Maney scrapers, respectively:

The above calculations are based on round trip times, including over 15 per cent for lost time, or more than 1½ hours per day. The table was made from operations run under average conditions on level ground, and shows results that may be expected if the outfit is efficiently handled.

Below is shown dynomometer record of a 5-ton "caterpillar" pulling 3 Maney four-wheel scrapers, which was taken February 15, 1921, through a rolling field, soil, medium damp clay; showing all phases of operation within drawbar horsepower of the tractor.

Pounds Pull on Draw Bar

	Maximum*	Average	
Loading 1st scraper	6200	4960	at 1½ miles per hr.
Loading 2d scraper	5800	4520	at 1½ miles per hr.
Loading 3d scraper	6000	4800	at 1½ miles per hr.
Hauling loaded scrapers:			
Maximum		2800	at 3 miles per hr.
Minimum		1600	at 3 miles per hr.
Average		2140	at 3 miles per hr.
Dumping:			
Maximum		3100	at 3 miles per hr.
Minimum		1800	at 3 miles per hr.
Average		2540	at 3 miles per hr.
Turning empty:			
Maximum		1360	at 3 miles per hr.
Minimum		960	at 3 miles per hr.
Average		1160	at 3 miles per hr.
Returning:			
Maximum		1500	at 5.71 miles per hr.
Minimum		500	at 5.71 miles per hr.
Average		928	at 5.71 miles per hr.

*NOTE.—The pounds pull on draw bar required to load first scraper is higher than that required to load second and third, because scraper operator took an extra deep bite with his pan and took up a load greater than one cubic yard.

Detail Time Table for 5-Ton "Caterpillar" Pulling Two 4-Wheeled Scrapers.

Length of haul in feet	300	600	900	1320	1800	2640
Round trip time	3 min. 55 sec.	5 min. 35 sec.	7 min. 25 sec.	9 min. 50 sec.	12 min. 25 sec.	17 min. 25 sec.
Cubic yards per trip	2	2	2	2	2	2
Cubic yards per 10-hr. day	262	214	160	122	96	68

Detail Time Table for 5-Ton "Caterpillar" Pulling Three 4-Wheeled Scrapers

Length of haul in feet	300	600	900	1320	1800	2640
Round trip time	4 min. 45 sec.	6 min. 10 sec.	8 min. 10 sec.	10 min. 35 sec.	13 min. 20 sec.	18 min. 10 sec.
Cubic yards per trip	3	3	3	3	3	3
Cubic yards per 10-hr. day	360	270	210	150	120	90

BOTH OUTFITS ON THE FILL

From costs on four months' time already put in on the contract, Mr. Mitchell figures that his tractor outfit shows him a saving of from 20 to 25 per cent over the cost of doing the same work with teams.

Vehicular Tunnel Commission Retires Its Consulting Engineers

The New Jersey Interstate Bridge and Tunnel Commission has announced through its chairman, T. Albeus Adams, that it had dismissed its entire staff of consulting engineers, comprising Col. William J. Wilgus, Major John A. Bensel, Professor William H. Burr, Edward A. Byrne, J. Vipond Davies and Col. George Watson.

The commission has for several weeks been unable to agree with the New York Commission on the proposed widening of Jersey City streets for entrance and plaza purposes and, in discussing the commission's action Mr. Adams said: "The New Jersey commission is obliged to dispense with the services of the consulting board as at present constituted, because of the conviction, forced upon it by recent events, that some members of the consulting board have not been as unbiased and impartial in their relations with the respective tunnel commissions as the nature and purpose of the board's employment require. Believing that the employment of a joint consulting board, for this reason, has proved unworkable, as it certainly has been unsatisfactory, the New Jersey commission has determined to obtain its own technical consultants, and trusts that the New York commission will do likewise."

General Wage Reduction

A review of reports throughout the United States indicate that in the 19 states from which reports are available there were about 2,000,000 men unemployed May 1, a large proportion of them in the industrial section of the eastern and central states. Reports from the other 29 states from which complete figures are not available indicate that the unemployment there will bring the total in the country up to at least 3,000,000.

There is throughout the country a general tendency for the reduction of wages, that is, of course, considerably facilitated by the unemployment, although in the east there is a general feeling on the part of labor that the peak of unemployment has been reached and a spirit of resistance to the cut. Action of the railroad board and the steel industry insure reduction in very large interests that will, of course, greatly strengthen the movement throughout the country. Strong resistance to the absolutely necessary cut in the wages of marine workers has led to a serious walk-out or strike that was anticipated by the United States Marine Board and the Standard Oil Company, both of which expect to be able to operate a considerable part of their fleets by seamen, engineers and captains recruited from the unemployed or from qualified men working at present in other capacities.

In the west, south and central states, wage cuts have already been effected in a number of important factories. In New England the wages of printers and street railway employees have been reduced simultaneously with rates.

In Boston 16,000 men are idle in the building trade and several other cities announce an intended cut of 20 per cent in wages. In New York State the traction companies and builders will cut wages. In Pennsylvania wages in many cases have been cut but those in the coal industry have been maintained because of agreements having another year to run. Workers in shipyards have accepted a reduction of 10 per cent. In Illinois there are fewer strikes than usual and labor leaders are reported as fearing lock-outs by manufacturers. In North Dakota farm wages will be cut 35 per cent this season. In Iowa about 60 per cent of the 30,000 normally employed in the building trade are idle.

Statistics published by the United States Department of Labor show that in 14 important industries the pay rolls for March, 1921, were much less than for March, 1920. In the iron and steel works the decrease is 44.2 per cent. None of the other decreases is directly related to building and construction interests. The decreases are partly due to smaller forces employed, and partly due to lower wages.

Federal Aid Highway Construction

The Chamber of Commerce of the United States, in convention at Atlantic City, gave serious consideration to the highway situation, and resolved that: In order that funds now to be spent for highway construction may adequately serve the economic purposes which are becoming clearly recognized, bonds should be issued by states and territories, counties or municipalities, and federal assistance furnished, only for portions of highway construction which are reasonably enduring and permanent in character.

Federal appropriations should be made only for assistance to state highways which will become a part of an interstate system.

Federal assistance should be continued only to those states which adequately maintain highways for which there has been federal aid.

Most careful study should be made by the federal government in co-operation with state governments as to routes, the probable character of service over such routes, and the best form of construction to meet such service. These studies should include ultimate economies of location and design.

Obtaining Bonds by Misrepresentation

An amendment to Chapter 306 of the New York State Penal Code has been enacted to make larceny include obtaining surety bonds by false financial statements. The pest of the contracting business has long been the "shoe-string" gambler who camouflages insufficient assets behind big surety bonds, obtained through misrepresentation. Hereafter, in New York State, this practice will be punishable "by imprisonment for not more than one year or by a fine of not more than one thousand dollars, or both."

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Public Works Booming

In spite of the hesitation of some public officials to begin construction work at the present time, the past month has shown that these are apparently in the minority and that a great many cities, counties and states believe it wise to contract at once for public works of various kinds.

PUBLIC WORKS collects data concerning contracts let throughout the country. While our records are probably more complete than any others collected, undoubtedly quite a number of contracts are let concerning which we receive no information. Also, no attention is paid to contracts of less than $5,000 or $10,000, and there are a great many smaller than this. It is possible, therefore, that our figures should be increased by 25 per cent to 50 per cent to represent the totals for the entire country. As an illustration of the tendency of the time we may give a few figures for the four weeks ending April 30. A greater part of the work is that connected with streets and roads, water supply, sewerage and sanitation, and bridges, and including these items alone, during the week ending April 9 our records showed contracts awarded amounting to $22,790,357. The following week the total was $22,510,905. The third week it was $25,331,057, and the fourth week the total was $34,694,006. This gives a total for the four weeks of more than $105,000,000, and for reasons stated above it is possible that the totals of the contracts let during that period will approximate $140,000,000.

Considering the classes of work contracted for, we find the totals for street and road work for the four weeks in question were $72,297,406; the water supply contracts totaled $9,161,363; the sewerage and sanitation work, $15,141,466; and the total for bridges was $8,726,090.

Dividing the total for each class by the number of contracts for that class in order to obtain the average size of the contracts under each head, we find that the average of the four weeks for street and road work was $113,319; for water supply, $81,074; for sewerage and sanitation, $98,964; and for bridges the average was $70,371.

While these figures seem large, they merely indicate a beginning of the season rather than the peak of it. For instance, they include something under $85,000,000 worth of street and road work, whereas there is known to be more than ten times this amount of work ready to be let for this season. The same is probably true of work connected with water supply systems, sewerage and bridges.

It is known that there is billions of dollars' worth of public work waiting to be done, and in most cases those in charge are ready to let the contract if they believe they can get reasonable prices. It would therefore seem to be up to the dealers in materials and to labor, and to contractors who must base their bids upon these, to make prices that will be acceptable to the public officials; and if they do so, all will find themselves with as much business on their hands as they can possibly undertake during the building season.

Garbage Reduction Uncertainties

Two or three years ago cities and private companies utilizing the saleable portions of garbage by means of reduction plants were making a profit if such is ever possible, as they were receiving unprecedentedly high prices for the grease and tankage sold. For instance, in 1918 the Philadelphia price of grease was as high as 11½ cents a pound and tankage was $11 a ton.

Since the war, however, prices of both of these have fallen and a few weeks ago the market price of garbage grease was 2¾ cents a pound and that of tankage was $5 a ton. Some report even lower prices. For instance, in a letter to the mayor of Boston in which it was asking relief from its contract with the city for disposing of the city's

garbage, the president of the Boston Development and Sanitary Company wrote: "The best offer that I could obtain last week for our grease was 2 cents a pound. The cost of manufacturing is 7½ cents a pound, inclusive of overhead, insurance, depreciation and maintenance. Tankage can no longer be manufactured as there is absolutely no market, all fertilizer manufacturers' store-houses being filled."

Even though the situation may not generally be as dark as this, those who are considering the adoption of reduction as a means of disposing of sewage should not be misled by reference to prices received in the past, but should realize that in the future they cannot expect to receive more than 20 per cent to 50 per cent of the high prices of war time. Operating costs of course have diminished also, but not in proportion to the decrease in the prices obtainable for reduction products.

Grease at 2 cents a pound and allowing 50 pounds per ton, and tankage at $5 per ton and allowing 200 pounds of tankage per ton of garbage would give a return of $1.50 per ton of garbage treated in a reduction plant. These are perhaps lower prices than can be obtainable at present, although higher than it was claimed by the Boston company that it could obtain; but not very much lower than several plants were receiving the early part of this year, and probably not lower than should be figured on in estimating the financial features of a proposed reduction plant. Either operation alone, or interest, depreciation, insurance and other fixed charges alone, would probably exceed this amount. If these figures are even approximately correct, the reduction process largely loses its attractiveness as a means of securing revenue from garbage disposal, or even of greatly reducing its cost.

Street Cleaning by Philadelphia

Since the first of the year, Philadelphia has been cleaning two of its street cleaning districts by municipal forces, as stated in our issue of January 22, 1921. Officials of the highway bureau are reported as saying that there is no question that streets in these two districts are cleaner than they have been for many years and also that this has had its effect on the contractors who are cleaning the other districts so that the city as a whole is better cleaned than it was when contractors were doing all of the street cleaning. Chief Fred. C. Dunlap and J. H. Meeson, principal assistant engineer in charge of street cleaning, state positively that the municipal cleaning also costs less than that done by contract. Bids for cleaning these two districts amounted to $1,485,668. The city appropriated $1,285,000 for cleaning the same districts and the officials say that they can keep within that figure, notwithstanding that the pay of the block men has been increased over that paid by the contractors and that it was necessary for the municipality to organize an entirely new force, obtain equipment and develop a new organization.

One of the advantages of municipal cleaning is shown by the fact that this year, with an early spring, night cleaning in the central section of the city was started a month earlier than was customary under the contract system, or probably than it would have been had a contract been in force fixing the date on which such cleaning should begin.

The Philadelphia officials find, as do those of other cities, that one of the greatest difficulties in keeping streets clean is the failure of co-operation by the citizens, who continually throw on them rubbish of all kinds, from matches to ashes, and especially paper of various kinds.

Boosting a Water Works Intake

The use of a booster pump between the intake crib of a water works plant and the main pumping plant is an unusual construction which was adopted by Geneva, Switzerland, as described by Monsieur A. Betant, engineer of the Geneva water works, in a paper presented to the New England Water Works Association through Professor George C. Whipple.

The city, which has a population of about 148,000, is supplied with unfiltered water from Lake Geneva. The water enters through an intake crib in about 49 feet of water at a distance of 1.55 miles from the harbor jetties and 0.8 mile from the shore immediately opposite. From the intake crib to the pumping station the water flows through a 48-inch pipe 12,000 feet long, laid on the bottom of the lake and of the Rhone river on which the pumping station is located. The water is pumped by means of hydraulic turbines of 3,000 horsepower capacity, power being supplied by the river Rhone.

Up to a few years ago, water flowed by gravity to the pumping station, the intake pipe having a capacity of between 13.7 and 18.3 million gallons a day. In 1913 it became necessary, because of the increase in water consumption, to enlarge the capacity of the conduit to 25.2 million gallons a day. Instead of laying a larger or a supplementary conduit, this increase in delivery was accomplished by installing an electrically operated centrifugal pump in the line of the intake conduit, at a point where the bottom of the lake is 13 feet below the surface. The pumps located at this point not only increase the discharge of the conduit to the main pumping plant, but, by placing this section of the conduit under pressure, prohibit the access through any leaking joint in the conduit of the water of the Rhone river, which is considerably more impure than that of the lake at the intake crib.

In installing this booster plant, a sheet iron caisson 23 feet in diameter at the base was constructed on shore and floated to the pump site and there sunk by filling it with concrete, until it rested on the level bottom of the lake. It was then secured by 16 anchor piles driven around the circumference. The caisson was placed about 50 feet to one side of the intake conduit. In con-

creting the caisson, a central chamber was left and in this a pump and motor were mounted, direct connected by a vertical shaft, the pump having a capacity of about 25 million gallons per day against a head of 10 feet at 200 r. p. m. After sinking the caisson, a 33-foot section of the conduit directly opposite the caisson was replaced by two special castings containing "Y" branches, a check valve being inserted between them, which permitted the pressure to adjust itself automatically when the pump was started; these branches being connected to the suction and discharge of the pump by means of 36-inch cast iron pipes passing through the wall of the caisson.

Electricity for operating the pump is provided by a special generator at the hydro-electric station, an independent cable connecting this with the booster pump. The pump is therefore under entire control from the station and it is not necessary to visit it oftener than once a month, when the pump and motor are oiled. This installation has been in regular operation since June, 1914.

Equitable Pay for Federal Employees

Employees in the various departments of the United States government, including the engineers in various bureaus by which public works are executed, feel considerable satisfaction over a recent committee report of the Chamber of Commerce of the United States, recommending "adequate and equitable pay for the army of more than half a million government employees as one of the series of proposals for the complete recasting of the federal civil service." Some time ago the National Federation of Federal Employees made recommendations along these lines and the president of that federation, Luther C. Steward, expresses gratification that the recommendation of the Chamber of Commerce of the United States is identical in eight of its nine points with the reclassification program advocated by the federation.

The committee of the Chamber of Commerce on April 24 sent the recommendation referred to to a referendum vote of the 1,400 industrial and commercial organizations in its membership. The recommendations to be voted on are as follows:

I. The present system under which personnel for the federal civil service is secured and managed should be recast.

II. Adequate and uniform pay under essentially like conditions should be established as a fundamental principle for the federal civil service through reclassification and regrading.

III. Reclassification should be by statute based on investigations already made and further investigation by the Civil Service Commission.

IV. Reclassification should be installed by the Civil Service Commission and the Budget Bureau and current correction made by Congress aided by these agencies.

V. Promotion should be given statutory recognition as the preferred method for filling vacancies, with lines of promotion clearly defined and promotions made upon the basis of proved merit under civil service regulations.

VI. All administrative officers not responsible for determining policies should be included under civil service rules.

VII. Transfers between departments should be regulated by executive orders consistent with the civil service law.

VIII. Efficiency records should be developed by the Civil Service Commission.

IX. Removal of an employee should be possible upon a written statement of reasons to the employee with opportunity for written reply, but without right of appeal above the head of the department.

Loading Test on a Bridge Foundation Pile

The bridge carrying Black street, Hamilton, Ohio, across the Miami river, has seven 93-foot concrete arch spans supported on concrete piers with pile foundations about 16 feet below the river bed. The 24 x 62-foot footings are supported by 150 20-foot wooden piles spaced 3 feet apart in each direction and driven to a penetration of 18 feet in sand and gravel by a 3,800-pound No. 3 Vulcan steam hammer operated in leads swung from the 70-foot boom of a Bucyrus drag-line caterpillar excavating machine.

One of the piles, 8 inches in diameter at the butt and 19 feet long, was driven to a penetration of 16 feet and to a refusal of ⅓ inch under the last blow of the hammer. It was subjected for three days to a test load of 30 tons of pig iron which produced only ¾-inch ultimate compression and settlement.

The top of the pile was sawed off horizontally about 3 feet above the bottom of the excavation and was capped with a steel plate affording bearing for a 12 x 12-inch horizontal timber 7 feet long supporting the 7 x 7-foot loading platform knee braced to the pile. The platform was additionally supported by temporary jack screws until the pig iron had been piled on it, when the jack screws were released, transferring the entire load to the pile and producing some compression in the timber of the platform and of the pile which was included in the ¾-inch platform settlement recorded.

Bituminous Paving for Japan

Professor T. Takakuwa, of Kiriu University, Tokio, Japan, a commissioner for the Japanese government, who has spent more than a year investigating street improvements in America and Europe, is now on his way across the United States with the expectation of reaching Japan within the next few weeks. He states as his opinion that asphalt should be adopted very largely for paving the streets and roads of his country.

Several years ago some asphalt pavement was laid in Tokio, but in a ridiculously primitive manner and without any mechanical equipment, and naturally proved to be a failure. Many engineers in Japan are in favor of wood block pavement. However, although there is considerable timber in the country, it is being used up at about double the rate at which it is being grown. Professor Takakuwa expects to recommend the adoption of bituminous pavement and laying it by means of modern equipment, such as is used in the United States. It is expected that Tokio will begin laying new pavements throughout the city before summer of this year and that Osaka and other of the principal cities will begin paving in the immediate future, possibly this year.

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Minnesota (continued):						
Jackson	$204,000	20 gravel	all E	$200,000	14 grading, 20 gravel	all E
Kandiyohi	350,000	4 conc., 15 grading, 20 gravel	grad. & grav. E pavement C	185,000	2 conc., 20 grading, 20 gravel	2 conc. C, rest E
Lac Qui Parle	360,000	73 gravel, 22 graded	all grading, 35 gravel E, 48 gravel C	220,000	50 grading	all E
Lincoln	62,855.75	7 gravel	all C	70,000	12 grading	¾ E, rest C
Lyon	292,115.85	21 grading, 21.44 gravel	grad. & maint. E grav., bdgs., etc., C	325,000	18½ graveling, 25 grad'g, br. & culvt.	grading E, rest C
Marshall	400,000	240,000 gravel, 140,000 earth	all C	.....	$250,000 gravel, $150,000 earth	all C
McLeod	120,925.45	14 gravel	all C	80,000	8.5 grading, 14 gravel	10 gravel E, rest C
Millelacs	566,993.44	43,000 cu. yds. gra.	10,000 cu.yds.E 33,000 C	135,000	.....	all C
Nicollet	65,866.77	6 gravel	all E	90,000	8 dirt	all C
Nobles	514,000	6 conc., 15 gravel, 30 grad.	8 gravel E rest C	.....	20 grading, 20 gravel	all C
Pope	200,000	16 gravel, 8 grade	grade E grade & gravel C	120,000	3½ F.A.P., 6 grading	.....
Redwood	213,942.27	48 gravel	60% E 40% C	195,000	40 graveling	50% E, 50% C
Roseau	18,734.32	1.1 gravel	$2,032.51 E 16,701.81 C	110,000	14 gravel, 4 earth	all C
Stearns	150,000	10,000 gravel	all E	150,000	10,000 clay sand, 15,000 gravel	all E
Steele	60,962	4 grading, 2½ gravel	gravel E grading C	142,000	17 grading & gravel'g	graveling E, grading C
Stevens	337,493.36	4.499 cem. conc., 15.04 gravel, 18 earth	all C	.....	5.501 cem. conc., 2 graveling & grading, 12 earth	2 gravel E, rest C
Swift	342,199.62	6 conc., 16 grav., 8 dirt	4 grav., 8 dirt E 12 grav., 6 con. C	50,000	maint. & repair	all E
Wadena	40,000	.....	30,000 E 10,000 C	85,000	1-2 sand clay	most E
Winona	150,000	all grading	50% E 50% C	200,000	5 conc., 150 maint.	maint. E, rest C
Mississippi:						
Adams	98,000	3.6 gravel surface	all C	250,000	12 gravel surface	all C
Benton	.....	11.8 left from 1919	....	350,000	11.8 gravel, 30 graded earth	all C
Harrison	.....	2,582 war.-bit.	....	.....	.....	.....
Lafayette	.....	small amts.	all E	150,000	80 grading & surfacing with sand clay	all C
Lincoln	[illegible]000	52,700 conc. bridges rest gravel	50,000 E 82,000 C	30,000	10,000 gravel, 20,000 conc. bridge	gravel E, bridge C
Lowndes	100,000	mac.	all C	50,000	mac.	all C
Missouri:						
Butler	50,000	repair & maint.	all E	250,000	2 fed. aid projects	all E
Caldwell	120,000	grading, bridges	all E	150,000	grading, bridges	90,000 E, 60,000 C
Carter	40 000	dirt	all E	60,000	19 dirt	Indef.
Cedar	.....	dirt	all E	100,000	.....	some C
Clark	45,000	dirt	grading E bridges C	75,000	14 dirt, 10 gravel	all C
Cooper	75,000	brick, conc., bit.	all C	150,000	bit. mac., brick, tarv.	all C
Henry	60,000	earth, maint.	all E	150,000	28 earth, 14 gravel	all C
Lincoln	37,200	10,000 culvts. & bridges	all E	.....	.....	.....
Macon	20,000 to 35,000	none	none	60,000	hard surfacing	all C
Mississippi	166,000	5½ conc.	all C	456,000	9.8 conc., 6.93 conc. & gravel shoulders	all C
Monroe	52,000	100 graded earth	175 E	160,000	7½ gravel, rest earth	20,000 E, 110,000 C
Ozark	5,000	none	40 C, rest E	80,000	20 binding	all C
Perry	18,000	3 rock & gravel	all E	24,000	rock & gravel	all E
Putnam	none	none	none	60,000	10 grading & bridg'g	all C
Ralls	39,754.42	252 graded	all E	60,000	2.6 finishing to grade, 11 grading, 2 grav.	all C
Schuyler	38,170	none	all E	none	none	.....
St. Clair	48,747.73	dirt	all E	50,000	.....	.....
St. Louis	.....	30,805 war.-bit.	....	.....	.....	.....
Sullivan	40,000	graded earth & bridges	state work C rest E	25,000	earth, $14,000 bridges	bridge E, state work C
Montana:						
Beaverhead	62,000	4 mac., 10 earth	2 grading C rest E	30,000	.....	all E
Big Horn	125,000	4 grav., 25 dirt, maint.	all E	110,000	maint., culvts.&brdgs.	bridges C, rest E
Blaine	350,000	27 gravel, 20 dirt	dirt E gravel C	none	none	.....
Carbon	200,000	19 gravel, 20 earth	all E	50,000	maint., drnge. struct.	all E
Chouteau	85,000	earth roads	60,000 E 25,000 C	55,000	regrading earth	all E
Fergus	450,000	130 earth, 3 grav. ½ con.	all C	300,000	60 earth, 5 gravel, ¾ conc.	all C
Flathead	215,000	14 gravel	all E	60,000	maint.	all E
Granite	90,000	8 grading, 4 gravel, $20 000 maint.	all E	200,000	11 regrading & grav.	all C
Hill	175,000	50,000 dirt, 100,000 gravel	125,000 E 50,000 C	200,000	50,000 dirt, 150,000 gravel	all E
Madison	90,102.93	culverts, maint.	all E	50,000	.....	all E
Meagher	160,000	44 grading, 5 earth 5 gravel, earth	20,000 E 140,000 C	60,000	Fed. Aid Proj.	all C
Musselshell	393,865.50	dirt	75% C, rest E	12,000	finish wk. under way	all C
Prairie	25,000	22 earth, 3½ gravel	large fills C rest E	30,000	30 grade, 5 gravel	large fills C, rest of work E
Stillwater	198,000	1 gravel, rest dirt	80,000 E 118,000 C	116,000	const. & maint.	41,000 C 75,000 E
Teton	183,000	23 gravel	all C	165,000	16 gravel	all C
Valley	78,000	2 fed. aid gravel	all E	50,000	10 gravel	all E

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Montana (continued):						
Wheatland	50,000	earth	28,000 E 22,000 C	50,000	40,000 earth	20,000 E, 20,000 C
Yellowstone	250,000	2 conc., 20 gravel	4 gravel E rest C	350,000	300,000 fed. aid	50,000 E, 300,000 C
Nebraska:						
Antilope	30,000	clay & gravel	all E	175,000	40 dirt	40 E, 18 C
Dakota	8,500	earth grading	all E	60,000	grading	½ E, ½ C
Deuel	44,000	.....	$50,000 E, 11 C	8,000	grading	all E
Dodge	40,999.68	$19.275 patrol of roads	....	.....	.....	.....
Hooker	25,000	sand clay	all E	30,000	sand clay & gravel	all E
Knox	200,000	62 earth, 2 gravel	45 grading E 18 C	75,000	5 gravel, 5 clay, mnt.	all E
Morrill	60,000	gravel, magnesia	16 E, 10 C	50,000	50	40 E, 10 C
Otoe	219,173.15	earth roads	115,000 E 104.173 C	285,000	40 earth, 400 grading	grading, br. E, earth & br. C
Rock	10,000	dirt	all E	10,000	.....	all E
Saline	54,140	earth	32,140 E 22,000 C	50,000	earth	50% E, none C
Sherman	70,000	soil surface roads	60,000 C	50,000	dirt	all E
Wayne	35,000	earth	all E	100,000	.....	50,000 E, 50,000 C
New Jersey:						
Atlantic	.....	7,333 war.-bit.	....	.....	.....	.....
Burlington	800,000	17 sheet asphalt	all C	550,000	10 sh. asp., 1 conc.	all C
Cumberland	100,000	10 gravel	2 C, rest E	650,000	9 conc. 5 gravel	gravel E, conc. C
Essex	.....	29,581 war.-bit.	.....	.....	.....	.....
Hunterdon	150,000	5 pen. mac., 45 mac.	all C	200,000	2 pen. mac., 4 asp. conc., 6 mac., 65 maint.	maint. E, 8 C
Mercer	531,300	1½ sh. asp., ¼ block, ½ conc., 5 mac.	all C	350,000	4 sh. asp., 2 pen. mac.	all C
Middlesex	.....	14,070 war.-bit.	....	.....	.....	.....
Monmouth	.....	2,888 war.-bit.	....	.....	.....	.....
Morris	.....	52 239 war.-bit.	....	.....	.....	.....
Passaic	434,900	12,534 sq. yds., asp., 8.640 mac., 3,037 bitoslag, 5,318 amiesite, 10.030 natl., 7,640 war., 22,-920 conc., 8,482 granite	all C	385,000	sh. asp., conc., mac., warrenite, amiesite	all C
Southern Div.	1,188,000	30 conc.	all C	.....	30 conc., 15 gravel	all C
Sussex	250,000	7 gravel, 6 bit. mac.	gravel E mac. C	445,000	3.4 grading, 10.5 grad. & graveling	$100,000 E, $260,000 C
Union	450,000	concrete	40,000 E, 410,000 C	600,000	6½ cem. conc., 2½ bit. conc.	repairs E, rest C
New York:						
Broome	386,365	6.96 conc., 3½ asp. mac.	all C	175,000	.....	all E
Cayuga	331 437	5 conc., 20 mac.	5 C, rest E	735 000	15 bit. mac., 5 mac.	state wk. C, rest E
Chenango	677.000	13 mac., 1 bit. mac.	10 E, 14 C	1,200,000	13 conc., 25 bit. mac.	16 E, 28 C
Franklin	90,000	maint. & repairs	all E	90,000	maint. & repairs	all E
Jefferson	500,000	400 000 bit. mac.	maint. E const. C	800,000	35 bit. mac., 5 conc.	all C
Madison	200,000	15 mac.	10 E, 5 C	450,000	6 conc., 19 mac.	15 E, 10 C
Monroe	400,428	22 mac., 5 gravel	all E	426 681	30 mac., 7 gravel	all E
Nassau	124,600	concrete	all C	750,000	733,000 conc., 17,000 mac.	all C
Niagara	400,000	8 conc., 3 bit. mac., 20 w. b. & stone	wb & stone E rest C	750,000	24 conc., 20 bit. mac., 16 w. b. & stone	16 E, 44 C
Orleans	35,000	concrete	all C	140,000	4 conc.	all C
Oswego	510 000	16 mac., 10 asp. pen.	16 E 10 C	650,000	25 mac., 18 asp. pen.	25 E. 18 C
Otsego	385,000	12.62 mac., 4 grading, 6 concrete	4 E 18.62 C	250,000	3.5 conc., 4 mac., 8 conc. possibly	4 E, 3.5 C
Yates	166,141	9.63 mac.	all E	150,000	.....	108,000 C
North Carolina:						
Beaufort	400,000	5 sheet asp., 5 war.	all C 50% C	400,000	4 war., 1 conc. 10 uncertain	all C
Buncombe	250,000	conc. asp., sand clay	50% E	250,000	20 conc., 40 sand clay	snd. clay E, asp. C
Craven	100,000	8 brick, 10 dirt	dirt E brick C	none	.....	.....
Durham	199,714.62	31.680 sq.yds. gravel, 91.721 bit.	gravel E bit. C	300,000	40 mac.	all C
Guilford	.....	62,843 war.-bit.	....	.....	.....	.....
Lenoir	650,000	concrete	all C	950.000	same as 1920	all C
Mitchell	200.000	grading	all C	350.000	4 hard surfacing	all C
Randolph	75 000	50 gravel & topsoil	62 000 const. & maint. E Fed. aid C	.....	.....	50.000-75,000 E 21 fed. aid C
Wake	.....	74.194 war.-bit.	....	.....	.....	.....
Washington	51 000	5 sand clay	all E	.....	.....	.....
Watauga	30.000	dirt	all E	75,000	9-19 gravel	all C
Wayne	131,203.98	$94.665.86 sand clay ,gravel surface	all E	.....	20 sand clay, hard surface	sand clay E
Wilkes	200.000	1 cement. 50 topsoil	all E	300,000	.....	all E
Wilson	56,000	25 sand clay & grav.	all E	120,000	7¾ gravel, 6½ sand clay	all E
Yancey	130,000	16 grading, 3 bridges	all E	30,000	.....	.....
North Dakota:						
Barnes	150.000	.....	all C	70.000	.....	all C
Grand Forks	57.826 72	6 gravel	all E	150,000	½ conc. 17 gravel, 40 dirt	½ E, ½ C
Grant	75 000	3 gravel, rest earth	50% E 50% C	78,000	25 earth	15 E, 10 C
McIntosh	30.000	dirt	3,000 E, 27,000 C	40.000	.....	practically all C
McKenzie	35.000	earth	all C	none	repairs	10.000 C
Mountail	75.000	dirt	120 grader work E 50 C	125,000	15 dirt	100 grader wk. E 75 C
Pembina	18,000	earth grade	all C	.....	.....	.....

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North Dakota (continued):						
Pierce	45,000	5 clay, 10 gravel, earth	none E 25% C	45,000	30-40 gravel, 5 clay, earth	all C
Ward	123,587.45	6 gravel, 10 earth	2% E 98% C	150,000	25 gravel	20% E, 80% C
Ohio:						
Allen	50,000	10 mi. dump pike	all C	610,000	21	15 C
Ashtabula	275,000	4 mac., 8 brick	all C	700,000	27 bit. mac., 15 brick	all C
Carroll	75,000	macadam	all C	400,000	15 bit. mac.	all C
Champaign	300,000	2½ concrete	all C	900,000	22 conc., 18¾ crushed stone	all C
Clark	133,000	maintenance	all E	805,000	19 conc.	all E
Clermont	250,000	macadam	25,000 E 225,000 C	360,000	mac.	all C
Clinton	135,000	none	....	450,000	8 conc., 4 rolled stone	all C
Columbiana	588,530	8.48 brick, 3.24 mac. 3.50 conc., 1.5 grading	all C	665,627	4.96 brick, 1.34 mac., 28.3 grading	all C
Coshocton	242,406.23	2 conc., 2.5 brick, 6 gravel	gravel E rest C	195,000	7.5 conc. or brick, 2.5 brick	80,000 E 337,000 C
Darke	700,000	175,000 brick, 325,000 conc., 200,000 gravel	all C	1,250,000	22 brick or conc., 10 gravel	all C
Erie	400,000	mac., conc. & brick	100,000 E 250,000 C	1,000,000	mac., conc. & brick	150,000 E 850,000 C
Fairfield	165 000	2.3 gravel, 35 mac., maint.	75,000 E 90,000 C	400,000	5 brick or conc., 6 bit.	75,000 E
Fayette	335,000	mac.	all E	.....	10 mac.	all C
Fulton	353,000	mac.	252,000 C, rest E	391,000	13 conc., 8 mac.	21 C
Hamilton	....	8.891 war.-bit.		.....	.....	.....
Henry	200,000	mac.	all C	340,000	7 mac., 4 conc.	all C
Highland	900,000	mac.	all C	500,000	$10,000 mac., 400,000 mac. or rock asp.	25,000 E 475,000 C
Holmes	72,259.15	4.5 gravel, 2.5 grade	2.4 gravel E rest C	486,000	6.25 brick, 5.45 conc., 1.75 mac., 4 gravel, 9.4 grade	2 gravel E, rest C
Jackson	.....	.....	....	.....	6 mac. or conc.	.....
Jefferson	65,000	none	....	750,000	7 brick, 4 mac., 24 mac. surface	maint. E, rest C
Licking	286,843	242.117 conc., 44,726 pen.	all C	491,000	4 conc., 7 pen.	pen. maint. E rest C
Marion	350,000	6 bit.	150,000 E, 200,000 C	.....	22 bit. mac.	.....
Meigs	20 000	1.75 mac.	all E	300,000	22 mac.	all C
Ottawa	350,000	conc.	all C	320,000	8 conc.	all C
Pickaway	.....	tar mac.	4 E, rest C	.....	12 gravel, 6 tar or brick	2 E, 16 C
Putnam	140,000	mac.	120,000 E, 20,000 C	518,000	21.5	surf. treating E, rest C
Richland	423	½ conc.,12.8 bit. mac., 5½ gravel	5.3 E 13.5 C	340,000	3½ brick, 5 bit. mac., 5 gravel	all C
Ross	60,000	1 brick	all C	none	1 brick	all C
Sandusky	815,000	11.5 brick, 1 conc., 12 mac.	all C	200,000	.5 brick, 3.5 conc., 12 mac.	all C
Summit	375,000	conc.	all C	1,000,000	24 conc.	all C
Trumbull	1,245,000	4 brick, 32 bit. mac.	all C	2,000,000	18 brick, 2 conc., 25 mac.	all C
Tuscarawas	100,000	1½ conc., 3½ mac., 5 dirt	10 C	500,000	8 brick, 6 conc., 8 bit. mac.	20 C
Union	100 000	mac.	all C	400,000	100 mac.	all C
Warren	210,000	none	118,136 C, rest E	.....	17½ mac.	all C
Williams	193,000	8 bit. mac.	all C	580.000	2 rock, 18 bit. mac., 6 gravel	all C
Oklahoma:						
Beckman	55,000	dirt	30,000 E, 25,000 C	50,000	5 gravel, 20 sand clay	10,000 E, 40,000 C
Bryan	100,000	dirt, bridges	....	1,400,000	80 gravel	all C
Carter	400,000	.....	....	550,000	26 gravel	almost all C
Choctau	95,000	30 dirt	all E	660,000	57 gravel	all C
Craig	38 000	grader work	all E	52,000	none	.....
Dewey	47 200	dirt	all E	42.600	dirt	all E
Garfield	627 000	7 conc. 20 dirt	dirt E, rest C	300,000	dirt, brdgs. & culvts.	10% E, rest C
Grady	300 000	bridge	....	100,000	bridges	all C
Hughes	200 000	earth	all E	60,000	hard surfaced roads	all C
Kingfisher	208,000	1 conc., 2 sand clay, earth	1 conc. C rest E	.....	1 conc., 3 sand clay	1 conc. C, rest E
Latimer	7,500	dirt	all E	47,500	fed. project	½ E
Leflore	90,000	dirt. bridges	bridges C rest E	30,000	telford & burnt shale	½ E
Major	185,000	100,000 earth, 85 000 culverts & bridges	50% E 50% C	.....	earth	all C
Oklahoma	150 000	dirt	all E	150 000	13 conc. or asp.	dirt E, 13 C
Pottawatomie	402 500	earth	247,000 E 155 000 C	200,500	earth	150,000 E. 50,500 C
Oregon:						
Clatson	.....	2 962 war.-bit.	....	.....	.....	.....
Columbia	.....	4 185 war.-bit.	....	.....	.....	.....
Hood River	.....	23 000 war.-bit.	....	.....	.....	.....
Jackson	...	8.000 war.-bit.	....	.....	.....	.....
Lake	75 000	gravel	all C	60,000	to complete 3 hwys. now under constr., 8 state road	hwy. E, rest C
Lane	.....	16.000 war-bit.	....	.....	.....	.....
Marion	800 000	20 asp., 100 grav. & mac.	all E	800,000	25-30 asp., 75-100 gravel & mac.	600,000 E, state work C
Morrow	301.121.19	6 rock & gravel, earth	107.994.82 E 93 126 37 C	308,796.83	30 crushed rock	.....
Multnomah	605,574 29	1 grade, 10 gravel, 14 mac., 2 pavement	....	531,000	maint., grading, mac., gravel, paving, etc.	400,000 E, 131,000 C

(To Be Continued)

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems different will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How Can a Brick Building with Foundations on Wet Sand Be Underpinned?

By sectional replacement without support: by replacing with temporary supports: by extension of original foundations: and by protecting existing footings.

It frequently happens that the stability of the exterior walls of a building are threatened through defects in the design, construction or endurance of their foundation; through heavier loading, vibrations, or through changed conditions inside or outside the building, especially the building of new structures close to the old building or the excavation of pits or trenches close to it below the bottoms of the old footings, or pile driving near them.

If the walls above the foundation are properly designed and in good condition the underpinning is easier for a wooden, steel or iron building. It is likely to present more difficulties and be slower and more expensive for a brick or stone wall.

The methods and operations vary a great deal with the character of the old footing and its location, the weight supported on it, the nature of the soil and underlying strata, condition of the building and the requirements for the new foundation, whether there is free access for the workmen and room for operations and equipment in the building itself and the outside space adjacent to the wall.

WITHOUT SUPPORTS

If the walls and footings are in good condition and the latter are seated on any hard, firm, dry soil and it is only necessary to enlarge the footings to give them a greater bearing surface on the soil or to carry them a few feet deeper to be below some adjacent excavation, the work is simple and easy, provided there are no restrictions to entering the lower story of the building and there is plenty of space there and in front of the wall for the execution of the work.

If the brick wall is in good condition and continuous and has no openings for a height of 8 to 10 feet above the footing it will be safe to excavate inside or outside the building, or both, adjacent and down to the bottom of the footing, and cut out full width sections of the latter about 4 feet long and 20 feet apart on centers. The wall will arch over the openings and require no temporary support or at the most only light boards to hold up bricks that may be loosened in the bottom courses. The openings and excavations can be made to the required width and depth of the new footing and the latter, usually of concrete, can be simultaneously built up to within about 2 feet of the underside of the old brickwork.

CONNECTING FOOTINGS TO WALL

Moderate size hard, sound stones with carefully dressed upper and lower surfaces can then be carefully bedded under the wall on top of the incompleted footings, pairs of steel plates placed on them separated by pairs of folding steel wedges and corresponding stones placed on the upper plates, reaching to the under side of the brickwork, where they are properly bedded with cement mortar the same as used for lower stones. The pairs of wedges can then be driven hard until the wall shows signs of displacement over them indicating that a large portion of the weight has been transferred through them to the new section of footing, after which the footing can be concreted up as high as possible and shimmed and grouted solid to the bottom of the brick wall.

After the completion of the first set of footings, a new set of holes can be put through the old footings midway between those of the first set, and the operations repeated, after which the footings in the spaces remaining between the old and new footings can be similarly removed and rebuilt thus eventually replacing the entire footing without ever having removed more than 20 per cent of the old total bearing on the ground.

Before commencing the work a careful survey of the building should be made and measurements and photographs taken of the walls, especially of the door and window openings and lintels or any incipient cracks which should be sealed with paper pasted over them, and accurate levels taken of the wall and repeated daily to detect any settlement or displacement. If any displacement is at any time observed the supports under the wall should be immediately supplemented by temporary jackscrews and blocking and braced, if necessary to prevent settlement. This precaution should always be taken if necessary with the various kinds of underpinning, hereafter described.

SHORING WITH NEEDLEBEAMS

If the ground is wet, soft, sandy or otherwise unstable the wall may require bracing or other temporary support while the underpinning is in progress, and the excavation for the new footing may require to be sheeted to prevent displacement of the adjacent soil and may also require pumping. Sheeting may consist either of vertical boards driven down with a maul as the excavation progresses, or of horizontal boards placed from the top down as the excavation progresses and having the ends of the longitudinal boards supported by bearing on the ends of the transverse boards. In quicksand or very wet soil it may be necessary to sheet with light interlocking steel sheet piles, but in this case the problem will probably require special treatment and supervision of an expert.

If the wall is not in good condition, or if it is very heavily loaded or subject to impact or vibration or if it is necessary for any reason to remove large portions of the old foundation at once it may be necessary to support the whole wall temporarily during the underpinning process and it may also require bracing and strengthening.

If in very bad condition the wall may be strengthened by rebuilding certain portions of it or by reinforcing it with beams or clamps bolted very tightly to it and it may be braced by heavy inclined timbers having their upper ends seated in slots cut into the face of the wall and their lower ends engaging wedges or jackscrews reacting against temporary foundations on the surface of the ground outside the building.

The simplest form of temporary supports are needlebeams, which are simply horizontal beams passed through openings cut in the wall just above the footing and supported at the ends in such a way as to provide for lifting the wall to compensate for any settlement in the temporary support due to the removal of the old footings or the excavation for the new ones. Needlebeams should be long enough as to have abundant clearance between their end supports for the excavation for the new footings. The inner ends of the beams are generally supported on timber sills parallel to the walls which, for heavy buildings, are usually set on a grillage of timbers transverse to the wall, distributing the load over a sufficiently large area of the cellar floor or the ground underneath the floor if the latter is removed. This method occupies a considerable space in the cellar or basement of the building and must be modified if the space is inadequate, obstructed or inaccessible. The outer ends of the needlebeams are usually supported on jackscrews and wedges on vertical shores or cribbing built up from the surface of the ground. Wedges or shims are driven between the wall and the tops of the needlebeams to give solid bearing for the latter and the wedges or jackscrews under the outer ends of the needlebeams are simultaneously set up sufficiently to start a horizontal crack between the brick walls and the footings, thus demonstrating that the entire load has been transferred to the needlebeams before the removal of the old foundations is commenced.

ARRANGEMENT OF NEEDLEBEAMS

For comparatively light structures 12 x 12-inch timbers spaced up to 10 or 12 feet apart horizontally are frequently used for needlebeams, because they are of standard sizes, easily secured and easily disposed of in the open market. For heavier loads the spacing between the timbers is reduced and sometimes the timbers are used in pairs, in which case one is put directly over the other or sometimes even sets of four are used. When one timber is placed directly over another it may take bearing on the whole length of the lower timber and not be attached to it, in which case the two timbers will simply have double the strength of a single timber. Frequently, however, the strength is increased by supporting the upper timbers on fillers inserted between it and the lower timber at points intermediate between the wall and the supports of the lower timber, thus increasing the strength of the upper timber by reducing its span, and increasing the strength of the lower timber by shifting the load to points nearer the supports. If the two 12 x 12-inch timbers are in contact throughout their entire length and are thoroughly keyed and bolted together, their strength may be approximately four times as great as that of a single 12 x 12-inch timber.

Sometimes the exterior ends of the needlebeams are carried on sills parallel to the wall and the sills are supported on heavy cribs or grillages that distribute the load over the surface of the ground. Frequently two or more lines of sills are used and the upper line on which the needlebeams are bearing supported on jackscrews seated on a lower line or pair of sills. This allows a larger number of jackscrews to be easily arranged and operated, making the support of the building more uniform and provides conveniently for blocking and wedging between the jackscrews to permit the release of the latter, and to prevent any danger from possible breakage of screws.

The sills may be 12 x 12-inch timbers or have any other convenient cross-section or steel I-beams may be used for either the needlebeams or sills, or both. I-beams are usually taken from convenient stock most easily available, and may have height of from 10 to 20 inches and length of from 10 to 40 feet.

JACKSCREWS

Underpinning jackscrews are of very simple construction, consisting of a short screw having a capstan head with a spherical or conical bearing on a concave loose washer or bearing plate, and engaging a heavy wide nut bearing on the upper surface of a sill or on the end of a bored vertical timber from 2 to 10 feet long called a pump log. Jackscrews have capacities from 1 to 10 tons or even more, lighter ones can be made of cast or wrought iron and the heavier ones of steel, all of them having large square threads and a low pitch. They should be well lubricated with heavy grease, carefully inspected on every job to see that none of them are cracked or broken. The jackscrews, especially when used singly or in pairs, should be always promptly followed up by blocking and wedging to prevent dropping the load if the screw fails. The jackscrews should be operated simul-

taneously and uniformly with a man at every screw or with several men, each taking a certain group of screws, and starting together at a signal, operating the first screw in each group at half or quarter turn with a lever of standard length, then moving to the next screw and operating it the same at signal, and so on, until all the screws have been turned the same amount, after which the operation is repeated until the required results are obtained.

The wall should be inspected at regular intervals, daily or oftener, and the screws operated if necessary to take up any settlement that may have occurred due to the disturbance of the ground in the excavating operations. After the weight of the wall is fully transferred to the needlebeams the wall foundations may be entirely removed and the men working safely under the needlebeams can excavate and sheet a full length trench of the required dimension down to the necessary depth with a bearing safe from disturbance, or on better soil or on solid rock or hardpan, as the case may be. After the bottom has been inspected and then prepared the new footing is built in it and the foundation constructed up to a convenient height.

Jackscrews should then be inserted on the new footing in the intervals between the needlebeams, with suitable bearings against the under surface of the wall and should be operated until they take the load from the needlebeams, transferring it to the new foundation and footings and maintaining it there until the compression and settlement, which is usually appreciable even for solid strata and sometimes considerable for soft material, ceases, after which the new jackscrews may be slacked off, the load restored to the needlebeams, the intermediate jackscrews removed and the foundation built up to and connected with the wall at points between the beams and the weight of the building transferred to the new foundation by wedging as previously described or sometimes by simply shimming and grouting and releasing the jackscrews under the needlebeams, which are eventually removed and the foundation completed in the positions that they had occupied.

CANTILEVER NEEDLEBEAMS

If the cellar of the building or the space adjacent to the wall on the exterior is inaccessible for underpinning operations it is possible to carry on the latter from one side of the wall only, by means of cantilever needlebeams fulcrumed far enough away from the wall to permit space for excavation under the wall, and anchored at the long end of the cantilever arm by heavy loads of ballast or by reaction against the weight of the building and its contents. Similar cantilevers can be arranged to support the building from the exterior without entering the cellar or cantilevers from the outside may be fulcrumed from heavy rakers or inclined posts placed against the base of the building. It is also possible to carry on the excavating almost within the limit of the thickness of a heavy wall, if necessary, by the use of special methods that require expensive equipment and expert supervision and labor.

Where it is not allowable to interfere at all with the existing foundations, they may be extended by making sectional tunnels underneath them and building wider and deeper footings in the tunnel or additional footings may be built in the trenches alongside the old footings and bonded to the latter, or foundation piles, piers or walls may be driven on one or both sides of the old footings and support the latter directly or by means of transverse beams or girders seated on them and passing under the old footings. These methods are, however, elaborate and costly, and should be resorted to only under expert direction.

UNDERPINNING BY PROTECTION

Foundations having their footings on gravel, clay, earth, sand or even quicksand may be entirely adequate and satisfactory for existing conditions but may be threatened by contemplated excavations or other operations that may be adjacent to them that will disturb the soil or soil pressure and threaten the possibility of a settlement or displacement of the soil that would undermine the footing and cause settlement and displacement to the foundation.

In such case the foundations may be safeguarded by operations equivalent to underpinning that will confine the material already under the footings and prevent the possibility of its flowing away. This can sometimes be accomplished by simply driving a line of sheet pile close to a footing to a greater depth than the proposed new excavation or beyond the limit of soil displacements. Equivalent results may be obtained by building a concrete retaining wall in the same position to serve the same purposes as the sheet piling. This wall can be built before the other operations are commenced, by digging alternate pits and in them constructing sections of the remaining wall subsequently joined together by intermediate sections built in excavations made between the first sections and thus providing a continuous structure without exposing any large surface of the ground and without requiring difficult trenching and bracing. An advantage of such a retaining wall is that it may often form a necessary part of the permanent structure so that its construction may involve little or no expense in addition to that necessary for the other work.

Philadelphia's Big Paving Program

Philadelphia, according to Chief Fred. C. Dunlap, of the Bureau of Highways, is expecting to pave 60 miles of streets this year, $1,000,000 of the cost to be paid out of current revenues and $5,000,000 obtained from a loan. The paving program contemplates spending about $20,000,000 altogether paving 50 miles each year for the next four years. The plan in general is to use this money not for repaving present overcrowded thoroughfares, but to attract traffic to new thoroughfares by giving them good modern pavements and thus draw away traffic from those which are already overcrowded. These streets include Delaware avenue, Fifth street, Germantown avenue, Ridge avenue, Spring Garden street, Gerard avenue and others.

NEWS OF THE SOCIETIES

May 16-18—AMBASSADORS & MINISTERS OF WORLD TRADE. Conference under auspices of NATIONAL ASSOCIATION OF MANUFACTURERS. New York City.

May 17—CLEVELAND SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual dinner.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

May 18—KENTUCKY LEAGUE OF LOCAL BUILDING ASSOCIATIONS. Newport, Ky.

May 18—BIRMINGHAM SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual business meeting. Southern Club.

May 19—EASTERN NEW YORK SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Edison Club Hall, Schenectady.

May 19 — SAN FRANCISCO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

May 20 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, 370th meeting. Engineering Societies Building, New York City.

May 20 — PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual dinner, Hotel Adelphia Roof.

May 21 — ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with ATLANTA SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

May 21 — CENTRAL PENNSYLVANIA SECTION. Spring meeting. State College with headquarters at University Club.

May 23-26—NEW JERSEY STATE BUILDING TRADES COUNCIL. Atlantic City, N. J.

May 25-6—NATIONAL INDUSTRIAL TRAFFIC LEAGUE. Cleveland, O

May 23-26 — AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting. Congress Hotel, Chicago.

May 31-June 3—NATIONAL ELECTRIC LIGHT ASSOCIATION. Pasadena, Cal.

June 14-16—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco.

June 15-17—LEAGUE OF MICHIGAN MUNICIPALITIES. Annual Convention. Kalamazoo, Mich.

June 20-24—AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting. Asbury-Park, N. J.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-8—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

NATIONAL TRAFFIC HIGHWAY ASSOCIATION

The annual meeting of the National Highway Traffic Association was held at the Automobile Club of America, 247 West 54th street, New York City, at 8 p. m., on Friday, May 13, 1921.

An informal dinner, at $1.50 per cover, was served in the Grill Room of the club at 7 p. m. The public was cordially invited to attend the dinner and take part in the discussion of the several topics to be presented.

Papers were presented on "Relation of Methods of Financing Highway Improvements to Present and Future Traffic," J. E. Pennybacker. "Highway Improvements Should Be Based on Transportation Surveys," Arthur H. Blanchard.

Reports were presented by the committee on sign posting for detours and through routes in municipalities; on regulation of overloading of motor trucks; on regulations covering speeds, weights and dimensions of motor trucks and trailers.

AMERICAN WATER WORK ASSOCIATION

Forty-first annual convention, Cleveland, Ohio, June 6-10, 1921. Executive committee meeting at 2 p. m. Other committee meetings. Group meetings—Arrangements will be made to have members in attendance Monday meet in small groups interested in topics that will be announced later. Evening—Address of welcome and informal reception with dancing.

June 7—President's address. Progress in Filtration, by J. W. Ellms. Construction Progress of the Cleveland Water Works, by A. V. Ruggles. Operation of the Mechanical Department of the Cleveland Water Works, by L. A. Quayle.

Afternoon—Effect of Cleaning Mains at Kansas City on Their Capacity, by C. S. Forman. The Waste of Water in Detroit, by G. H. Fenkell. Water Rates, by N. S. Hill, Jr., and J. N. Chester. Election, by districts, of members of the nominating committee. Ladies' auto trip to the Cleveland Yacht Club.

Evening—Water Supply from the Supply Man's View Point, by Charles Ade. Electrical Control of Valves, by Peter Payne Deane. Experience in the Development of Oil Engines, by F. B. Leopold; Standardization of Meters, by R. K. Blanchard.

June 8—The Romance of Water Storage, by Col. George A. Johnson. The Water Works of Erie, Pa., by John N. Chester. Reports of standing committes and special committees. General business. Selection of place for holding the 1922 convention.

Afternoon—Licensing Operators of Water Purification Plants in New Jersey, by Charles H. Capen, Jr. Improving the Scientific Features of Water Works Operation in Texas, by L. O. Bernhagen. The Small Plant Operator as a Scientist, by Abel Wolman. The Loading of Filter Plants, by H. W. Streeter. Tastes and Odors with Chlorination, by W. A. Sperry. Quality of Water at Different Points on a Water System, by S. T. Powell. State vs. Local View Point on Filter Plant Control, by Robert B. Morse.

Evening—Theater party for the ladies. Smoker for the men, Rainbow Room, Hotel Winton.

June 9—The Chemical and Bacteriological Section will hold separate meetings Thursday, program for which will be announced later. Report of committee on standardization of water meter specifications, Caleb M. Saville, chairman. Use of Dynamite in Breaking Out Old Water Mains, by Alvin Bugbee. Tapping Large Steel Mains Under Pressure, by D. F. O'Brien.

Afternoon—Mechanical Aids in Distribution Work, by W. M. Mitchell. Ownership and Operation of Trench Excavators and Other Mechanical Equipment by the Water Department of Baltimore, by V. Bernard Siems. Other practical operation papers. Discussion of superintendents' topics. Questions and answers. An afternoon card party for the ladies.

Evening—Moonlight boat ride, with dancing.

June 10—Superintendents' topics and questions continued. Superintendents' Day program will be continued in the afternoon if there is sufficient material and interest. Arrangements may be made for talks, illustrated by lantern slides and moving pictures for the evening.

ASSOCIATED PENNSYLVANIA HIGHWAY CONTRACTORS

At the first meeting of the Associated Pennsylvania Highway Contractors at Harrisburg, February 18, there were about 50 members in attendance and an announcement was made of the election by the board of governors of Chas. F. Puff, Jr., Assistant Chief Engineer of the Bureau of Highways, Philadelphia, as secretary and general manager with offices at 200 North 3d street, Harrisburg.

The association, which is a member of the Associated General Contractors of America, publishes a monthly bulletin in which there is now appearing a series of consecutive articles published under the headings following: General Factors, Excavation and Gravel, Concrete Pavement, Concrete Base Course, Sub-base Courses, Stone Backfill, High Culverts, Under-drain, Gutters, Curbing, Pavement, Bituminous and Other Pavements and Miscellaneous.

The officers of the association are S. M. Tarvin, W. D. Hill, E. P. Arbogast and Edward McCrady.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Materials Handling Division of the society has a membership of nearly 1,000 with an Aims and Organization Committee which reports, in part, that "material handling" divides itself into: (1) The consideration of the detailed design and operation of mechanical equipment for handling material, and, (2) the economical and efficient application of this equipment in the arts and industries.

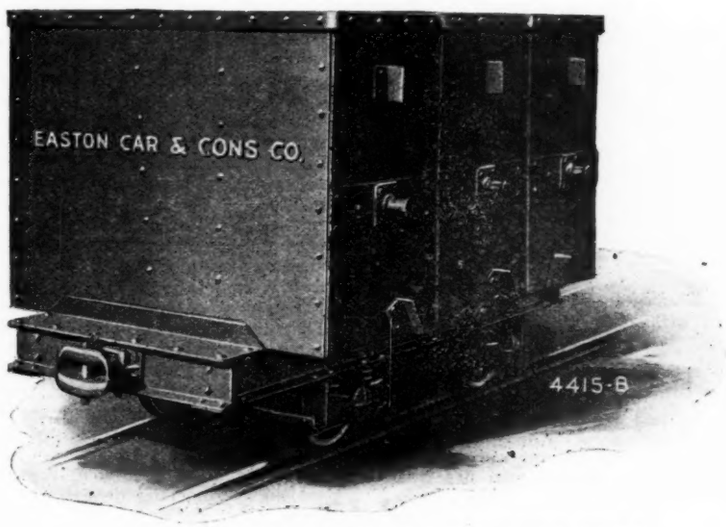
Material handling has to do with the multitudinous operations of "picking up and putting down" materials in process of production, and the handling problems of the linkages between common carriers and delivery to the user. The Professional Division, therefore, will approach the problem in general, as follows: Make a survey of the existing industry to ascertain the present state of the art.

Make studies for the improvement of machinery and equipment for the handling of materials.

Ascertain ways and means of reducing costs. An important branch of the work will be handling highway construction materials.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



THREE BOX FLAT CAR WITH STEEL BATCH BOXES

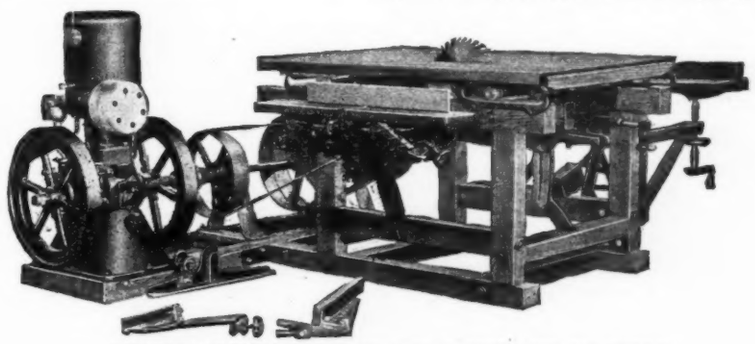
EASTON INDUSTRIAL RAILWAYS

The transportation of aggregate and cement between a central storage plant and the concrete mixing machine for highway construction is greatly facilitated by the use of Easton industrial railways equipped with two-box and three-box flat cars and bottom-dump and tip-over type batch boxes which are illustrated in Bulletin No. 510-A which shows the loading, unloading and transportation of materials with this equipment and gives several diagrams of different track arrangements for the service. Special prominence is given to the new three-batch box flat car, the use of which reduces the initial investment of car equipment by 20 per cent, train length by 15 per cent, dead weight of car by 10 per cent, and maintenance of cost by 36 per cent. The cost of labor is also reduced and the use of the resulting shorter trains makes operations quicker and more convenient.

The three-box car is equipped with standard foot brake, has a 3 x 8-foot frame, is 9 feet long over draw-head, weighs 1,250 pounds, and has a capacity of 6 tons. It will carry three batch boxes of 32 feet capacity or two of 64 feet capacity or, for gravel, macadam and cut-and-fill work, or wet concrete, can carry a rocker dump body of 40 feet capacity.

NOVO BEACH SAW RIG

The saw rig manufactured by the Novo Engine Co. is made in two sizes with 4 to 6 h. p. Novo reliable power engines with net weights of 1,550 pounds and 1,800 pounds without accessories and engines. The standard equipment includes a rip saw, cut-off saw, main drive belt, ripping and bevel gauge and a mitre gauge. It is furnished when ordered with jointer, boring attachment and an extension table.



ENGINE DRIVEN SAW RIG FOR CONSTRUCTION WORK

The bevel gauge permits making any cut that can be made on a tilting table, the mitre gauge can be set at any angle up to 45 degrees, and the frictionless roller table is an exclusive feature that enables heavy pieces to be handled as easily as light ones.

MARTIN PERFECT ROAD MAKER

The perfect road maker machine, manufactured by the Owensboro Ditcher & Grader Co., Owensboro, Ky., is a scraper hauled by teams or tractors, that is designed to surface the road with the blade working at one side and compensating hollows and projections so that the earth rolls out clean and follows a long projecting bar to the crown of the road, leaving the surface smooth and hard and in some cases completing the operation by one trip up and one trip down, thus acting as a time, labor and cost saver.

On all models the crucible plow steel cutting blade has both edges flanged and sharpened so that the machine can be used either for right or left-hand work. The heavy blade is 5 feet or 7 feet long in the different models and the landside is 9½ feet long. A steel plated wooden extension of the blade is 8 feet long, adjustable for different widths of roads and is attached to the rear end of the blade to move loose earth to the center of the road. The machine is provided with a special swivel joint, enabling it to be reversed in a minute, without the use of bolts or screws, while the horses or tractors are being turned. Besides road surfacing, the machine is efficient for cutting V-shape ditches and for backfilling pipe trenches.

CUTTING A ROAD ON NATURAL SURFACE

MAY 24 1921

ROAD TOOLS

Catalog No. 81 of the Baker Manufacturing Co. contains 48 pages of illustrations and descriptions of road tools and earth moving specialties. The 1-yard self-loading scrapers have been in successful use since 1912 and can be operated by tractors for digging, hauling, dumping and spreading dirt. They are used on road and street excavation, canal construction, reservoir building, quarry stripping, street widening, subdivision work and railroad grading. In average soil with tractor hauling they take up a full load in a distance of 10 to 20 feet and in a few seconds of time and plowing is unnecessary. They can be hauled by 15 to 20 h. p. tractors, according to the character of the soil and a 25 h. p. tractor can haul three 1-yard scrapers. A powerful tractor can haul as many as six scrapers, operated by two men, and, with the special ditcher supplied can finish a 25-foot road.

A ¾-yard scraper is built and can be hauled by a 12 h. p. tractor and is recommended for road and street work and short haul and team excavating.

The "Uncle Jim" self-operating road leveler No. 1 has a cutting width of 30 feet with two blades 25 feet long set to cut off all elevations and roll the dirt back to the low spots. The blades are curved to impart a rolling motion to the earth and can be instantly retracted to pass through a 10-foot clearance without stopping the machine.

The "Jim Dandy" No. 2 has 18-foot blades made with 6-foot sections that are sharp top and bottom, reversible and interchangeable. They will pass through 8-foot openings, and can be handled with a 15 h. p. tractor.

Leveler No. 3 is drawn by a 10 h. p. motor and is designed mainly for patrol work, for quick and frequent maintenance on dirt roads. The speed is 14 feet when opened to full width. Four miles of road have been worked in an hour with ordinary tractors going over the road once.

Grader No. 5 is for use with light tractors. It has a reversing blade that can be set at any angle and locked in any position. It can cut to a depth of 8 inches below the bottom of the wheels. The No. 5 horse-drawn grader is similar to the tractor-drawn grader, has a blade 6 feet long and can be operated by either two or four horses. The 20th Century grader No. 1 hauled by two or four horses can be operated by the driver or by an extra man and weighs only 750 pounds. Buck or Fresno scrapers, drags and snow plows, the latter designed to be pushed by motor trucks or tractors, are illustrated.

INDUSTRIAL NOTES

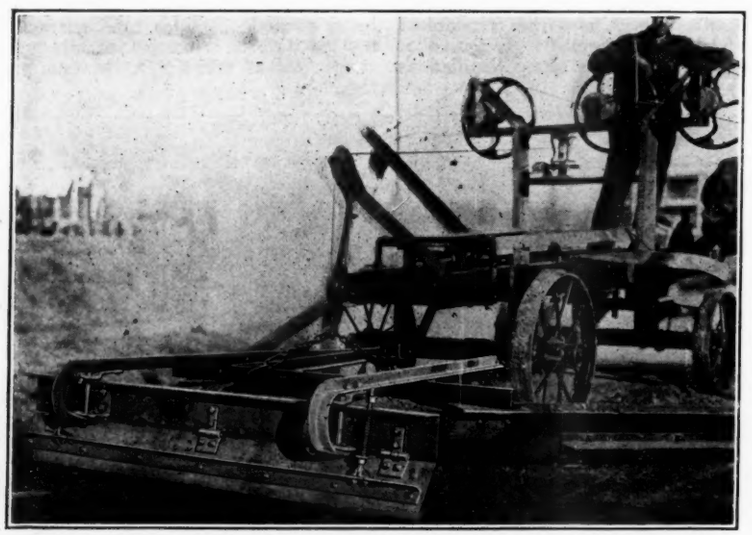
J. C. Tracy, for the past few years general sales manager of the Sterling Motor Truck Co., of Milwaukee, Wis., is now connected with the Hicks-Parrett Tractor Co., of Chicago Heights, in the capacity of vice-president and director of sales.

The Dominion Steel Products Co., Ltd., of Brantford, Ont., has made arrangements whereby it will manufacture gate valves and fire hydrants according to the designs of the Darling Valve & Manufacturing Co., of Williamsport, Pa.

BARBER-GREEN LOADERS ON PAVEMENT WORK

Barber-Green loading machines with self-feeding buckets have been used by the R. F. Conway Company and the Commonwealth Improvement Company, Chicago, and the Schmidt Construction Company, Chicago, and the Badger Construction Company, Milwaukee, for handling materials for concrete road construction. The jobs have been executed at the rate of 450 linear feet, with one mixer, 735 linear feet with two mixers, with total crews of 17 to 27 men. The total cost of handling broken stone and sand by the machine as compared with hand labor showed a saving of from $23.60 to $53.20 per day.

The Barber-Green machine has been successfully used for loading earth previously scraped into windrows for loading scarified macadam scraped into windrows, for digging surfacing materials from the right-of-way on highway construction, and for digging and loading gravel in a pit. Important features of the machine are the patented rotary disc feeder, the crawler type traction, and the adjustible measuring hopper with a capacity of 24 cubic feet that can discharge to either side of or in front of the machine.



BAKER ROAD LEVELER WITH AUTOMATIC DRAG ATTACHMENT FOR PRODUCING A FLAT SURFACE 5 FEET WIDE

PERSONALS

Randall, Ernest E., superintendent of the water department of Stoughton, Mass., has recently resigned that position.

Cook, Holton, is now resident engineer with the Kentucky Highway Commission on the constructing of a federal aid road, and will be located at Dixon, Ky.

Doolittle, Fred C., has been appointed highway maintenance engineer for Whitman county, Wash.

Morell, Samuel, Jr., has been made chief structural engineer of the Sanitary District of Chicago, and Julius R. Hall principal assistant engineer.

Francisco, J. O., formerly field engineer of the Colorado State Highway Commission, is now road engineer of La Platte county, in charge of maintenance and construction.

Murray, Leonard, is now in the employ of the engineering department of Watertown, N. Y.

Baum, H. J., formerly assistant engineer at Johnstown, Pa., has been appointed city engineer of Altoona, Pa.

Mead, Thomas, has been appointed county engineer of Whitman county Wash.

Chaffins, Major Clyde J., has been made office engineer of the Idaho Bureau of Highways in the Coeur d'Alene office under W. J. Bassett, district engineer.

Spring, C. H., is now office engineer of the division office of the North Carolina State Highway Commission at Greensboro, N. C.

Nason, David J., has been elected city engineer of Bangor, Me.

McKee, J. B., has been elected city engineer of Plattsmouth, Neb.

Anderson, Nels J., has been elected city engineer of Stromsburg, Neb.

Peterson, Carl H., formerly city engineer of Cadillac, Mich., has been appointed city manager of Mt. Pleasant, Mich.

Mahaffy, J. L., has been appointed town engineer of Montreal West, Que.

Peck, Frank S., formerly state highway engineer of South Dakota, has been appointed highway engineer of Minnehaha county, S. D.

Brownell, James P., has been appointed city engineer of Carthage.

Teed, A. J., has been appointed to the position of city engineer of Cadillac, Mich.

Hastings, Elwin S., and White, Alfred E., have been appointed acting division engineers of the New Hampshire State Highway Department.

Burton, Frank, has been appointed commissioner of the department of buildings and safety engineer of Detroit, Mich.

Tong, B. H., formerly assistant city engineer of Bismark, N. D., has been appointed superintendent of highways of Emmons county, N. D.

Moore, Warren E., has been elected commissioner of public works of Oklahoma City.